**3GPP TSG RAN WG1 #100b R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Agenda item:** 7.2.6.3.

**Source:** Moderator (LG Electronics)

**Title:** Summary of email thread [100b-e-NR-eMIMO-MB1-03]

**Document for:** Discussion and Decision

# Introduction

This contribution summaries discussion in email thread [100b-e-NR-eMIMO-MB1-03] which includes Issue#13, Issue#14, Issue#15, Issue#3 and Issue#7 in R1-2002725.

# Background and Summary of Proposal

Issue#13: For default PL RS/spatial relation, it needs to be clarified that ‘the lowest ID CORESET’ refers to ‘the lowest ID CORESET of the active DL BWP of the serving cell’. MediaTek also propose to refine the spec text based on that DCI0\_0 cannot be used for cross-carrier scheduling.

TPs for Issue#13:

TP#1 for clause 7.3.1 of TS38.213 (converged TP from ZTE and MediaTek):

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| 7.3.1        UE behavior  < Unchanged parts are omitted >  -  is a downlink pathloss estimate in dB calculated by the UE using RS resource index  as described in Clause 7.1.1 for the active DL BWP of serving cell  and SRS resource set  [6, TS 38.214]. The RS resource index  is provided by *pathlossReferenceRS* associated with the SRS resource set  and is either an *ssb-Index* providing a SS/PBCH block index or a *csi-RS-Index* providing a CSI-RS resource index If the UE is provided *enablePLRSupdateForPUSCHSRS*, a MAC CE [11, TS 38.321] can provide by *SRS-PathlossReferenceRS-Id* a corresponding RS resource index for aperiodic or semi-persistent SRS resource set  - If the UE is not provided *pathlossReferenceRS* or *SRS-PathlossReferenceRS*, or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from the SS/PBCH block that the UE uses to obtain *MIB*  - If the UE is provided *pathlossReferenceLinking*, the RS resource is on a serving cell indicated by a value of *pathlossReferenceLinking*  - If the UE  - is not provided *pathlossReferenceRS* or *SRS-PathlossReferenceRS*,  - is not provided *spatialRelationInfo*, and  - is provided *enableDefaultBeamPlForSRS*  the UE determines a RS resource index  providing a periodic RS resource with 'QCL-TypeD' in  - the TCI state or the QCL assumption of a CORESET with the lowest index on the active DL BWP, if CORESETs are provided in the active DL BWP of the serving cell  - the active PDSCH TCI state with lowest ID [6, TS 38.214] on the active DL BWP, if CORESETs are not provided in the active DL BWP of the serving cell  < Unchanged parts are omitted > |

TP#2 for clause 7.1.1. of TS38.213 (TP from MediaTek):

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| 7.1.1 UE behaviour  < Unchanged parts are omitted >  -     If  -     the PUSCH transmission is scheduled by a DCI format 0\_0 on a cell,  -     the UE is not provided PUCCH resources ~~for~~ on the active UL BWP of the cell, and  -     the UE is provided *enableDefaultBeamPlForPUSCH0\_0*        the UE determines a RS resource index  providing a periodic RS resource with 'QCL-TypeD' in the TCI state or the QCL assumption of a CORESET with the lowest index in the active DL BWP of ~~the scheduling cell for~~ the ~~serving~~ cell  -     If  -     the PUSCH transmission is scheduled by a DCI format 0\_0 on a cell,  ~~-     the UE is not provided a spatial setting for PUCCH resources on the active UL BWP of the primary cell [11, TS 38.321], and~~  -     the UE is configured with PUCCH resources on the active UL BWP of the cell where all the PUCCH resource(s) are not configured with any spatial relation, and  -     the UE is provided *enableDefaultBeamPlForPUSCH0\_0*        the UE determines a RS resource index  providing a periodic RS resource with 'QCL-TypeD' in the TCI state or the QCL assumption of a CORESET with the lowest index in the active DL BWP of the ~~primary~~ cell  < Unchanged parts are omitted > |

TP#3 for clause 6.1 of TS38.214 (converged TP from ZTE, Spreadtrum, and MediaTek):

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| 6.1 UE procedure for transmitting the physical uplink shared channel < Unchanged parts are omitted >  For PUSCH scheduled by DCI format 0\_0 on a cell, the UE shall transmit PUSCH according to the spatial relation, if applicable, corresponding to the dedicated PUCCH resource with the lowest ID on the active UL BWP of the cell, as described in Clause 9.2.1 of [6, TS 38.213].  For PUSCH scheduled by DCI format 0\_0 on a cell and if the higher layer parameter *enableDefaultBeamPlForPUSCH0\_0* is set 'enabled', the UE is not configured with PUCCH resources on the active UL BWP of the cell and the UE is in RRC connected mode, the UE shall transmit PUSCH according to the spatial relation, if applicable, with a reference to the RS with 'QCL-TypeD' corresponding to the QCL assumption of the CORESET with the lowest ID on the active DL BWP of the cell.  For PUSCH scheduled by DCI format 0\_0 on a cell and if the higher layer parameter *enableDefaultBeamPlForPUSCH0\_0* is set 'enabled', the UE is configured with PUCCH resources on the active UL BWP of the cell where all the PUCCH resource(s) are not configured with any spatial relation and the UE is in RRC connected mode, the UE shall transmit PUSCH according to the spatial relation, if applicable, with a reference to the RS with 'QCL-TypeD' corresponding to the QCL assumption of the CORESET with the lowest ID on the active DL BWP of the cell in case CORESET(s) are configured on the cell.  < Unchanged parts are omitted > |

TP#4 for clause 6.2.1 of TS38.214 (TP from MediaTek):

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| 6.2.1       UE sounding procedure  < Unchanged parts are omitted >  When the higher layer parameter *enableDefaultBeamPlForSRS* is set ‘enabled’, and if the higher layer parameter *spatialRelationInfo* for the SRS resource, except for the SRS resource with the higher layer parameter *usage* in SRS-ResourceSet set to 'beamManagement' or for the SRS resource with the higher layer parameter *usage* in SRS-ResourceSet set to ‘nonCodebook’ with configuration of *associatedCSI-RS*, is not configured in FR2 and if the UE is not configured with higher layer parameter(s) *pathlossReferenceRS*, the UE shall transmit the target SRS resource on a CC  -     with the same spatial domain transmission filter used for the reception of the CORESET with the lowest *controlResourceSetId* in the active DL BWP ~~in~~ of the CC.  -     with the same spatial domain transmission filter used for the reception of the activated TCI state with the lowest ID applicable to PDSCH in the active DL BWP of the CC if the UE is not configured with any CORESET in the active DL BWP of the CC  < Unchanged parts are omitted > |

Issue#14: For simultaneous multi-CC TCI/spatial relation update, RRC parameter names introduced in TS 38.331 are not aligned with TS38.213 and TS38.214.

TP#5 for clause 10.1 of TS38.213 (TP from Huawei):

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| < Start of text proposal on TS 38.213 v16.1.0 Section 10.1>  < Unchanged parts are omitted >  - an antenna port quasi co-location, from a set of antenna port quasi co-locations provided by *TCI-State*, indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in a respective CORESET;  - if the UE is provided up to two lists of cells for simultaneous TCI state activation by *simultaneousTCI-UpdateList and/or simultaneousTCI-UpdateListSecond*, the UE applies the antenna port quasi co-location provided by *TCI-States* with same activated *tci-StateID* value to CORESETs with index in all configured DL BWPs of all configured cells in a list determined from a serving cell index provided by a MAC CE command  < Unchanged parts are omitted >  < End of text proposal on TS 38.213 v16.1.0 Section 10.1> |

TP#6 for clause 6.2.1 of TS38.214 (TP from Huawei):

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| < Start of text proposal on TS 38.214 v16.1.0 Section 6.2.1>  < Unchanged parts are omitted >  When a *spatialRelationInfo* is activated/updated for a semi-persistent or aperiodic SRS resource configured by the higher layer parameter *SRS-Resource* by a MAC CE for a set of CCs/BWPs, where the applicable list of CCs is indicated by higher layer parameter *simultaneousSpatial-UpdatedList* or *simultaneousSpatial-UpdatedListSecond*, the *spatialRelationInfo* is applied for the semi-persistent or aperiodic SRS resource(s) with the same SRS resource ID for all the BWPs in the indicated CCs.  < Unchanged parts are omitted >  < End of text proposal on TS 38.214 v16.1.0 Section 6.2.1> |

Issue#15: According to TS38.321, legacy MAC CE is reused for multi-CC simultaneous PDSCH TCI state update. However, in TS38.214, it refers to a non-existing Section [6.1.3.x] of TS 38.321. In addition, TS38.214 needs to be updated according to the recent TS38.321.

TP#7 for clause 5.1.5 of TS38.214 (TP from vivo):

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| **TS 38.214**  **5.1.5 Antenna ports quasi co-location**  < Unchanged parts are omitted >  The UE receives an activation command, as described in clause 6.1.3.14 of [10, TS 38.321] ~~or in clause [6.1.3.x] of [10, TS 38.321]~~, used to map up to 8 TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'* in one CC/DL BWP or in a set of CCs/DL BWPs, respectively. When a set of TCI state IDs are activated for a set of CCs/DL BWPs, where the applicable list of CCs is determined by indicated CC in the activation command, the same set of TCI state IDs are applied for all DL BWPs in the indicated CCs.    When a UE supports two TCI states in a codepoint of the DCI field '*Transmission Configuration Indication'* the UE may receive an activation command, as described in clause ~~[~~6.1.3.24~~X]~~ of [10, TS 38.321], the activation command is used to map up to 8 combinations of one or two TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'*. The UE is not expected to receive more than 8 TCI states in the activation command.  < Unchanged parts are omitted > |

TP#8 for clause 6.2.1 of TS38.214 (TP from vivo):

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| **TS 38.214**  **6.2.1 UE sounding procedure**  < Unchanged parts are omitted >  - when a UE receives an spatial relation update command, as described in clause 6.1.3.26~~xx~~ of [10, TS 38.321], for an SRS resource, and when the HARQ-ACK corresponding to the PDSCH carrying the update command is transmitted in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions on updating spatial relation for the SRS resource shall be applied for SRS transmission starting from the first slot that is after slot The update command contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the updated SRS resource set. Each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the update command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the update command if present, same serving cell and bandwidth part as the SRS resource set otherwise.~~]~~ When the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set to 'antennaSwitching', the UE shall not expect to be configured with different spatial relations for SRS resources in the same SRS resource set.  < Unchanged parts are omitted > |

Issue#3: In RAN1#99, the default spatial relation has been agreed to be applied ‘at least for the single TRP case’ but this condition has not been captured in specification.

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| **Agreement@ RAN1#99**  The following working assumption is confirmed with revision in red  The default spatial relation for dedicated-PUCCH/SRS for a CC in FR2, at least when no pathloss RSs are configured by RRC is determined by   * ~~Default TCI state or QCL assumption of PDSCH, i.e.,~~ * in case when CORESET(s) are configured on the CC, the TCI state / QCL assumption of the CORESET with the lowest ID, or   + The PL RS to be used is the QCL-TypeD RS of the same TCI state / QCL assumption of the CORESET with the lowest ID   + Note: The PL RS should be periodic RS * in case when any CORESETs are not configured on the CC, the activated TCI state with the lowest ID applicable to PDSCH in the active DL-BWP of the CC * Above applies at least for UEs supporting beam correspondence * Above applies at least for the single TRP case * ~~FFS: Details on UE behavior in the absence of the activated TCI state~~ * ~~FFS: Details on default spatial relation in multicarrier scenario~~ * ~~FFS: Details on which RS to use for pathloss measurement~~ * ~~FFS: Details on how to handle this issue in case pathloss RSs are configured~~ |

TP#9 for clause 7.2.1, 7.3.1 and 9.2.2 of TS38.213 (TP from Apple):

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| 7.2.1 UE behaviour <unrelated part omitted>  - If the UE  - is not provided *pathlossReferenceRSs*, and  - is not provided *PUCCH-SpatialRelationInfo,* and  - is provided *enableDefaultBeamPlForPUCCH* , and  - is not provided different values of *CORESETPoolIndex* in *ControlResourceSets*  the UE determines a RS resource index  providing a RS resource with 'QCL-TypeD' in the TCI state or the QCL assumption of a CORESET with the lowest index in the active DL BWP of the same serving cell  <unrelated part omitted> 7.3.1 UE behaviour <unrelated part omitted>  - If the UE  - is not provided pathlossReferenceRS or SRS-PathlossReferenceRS,  - is not provided spatialRelationInfo, and  - is provided enableDefaultBeamPlForSRS, and  - is not provided different values of *CORESETPoolIndex* in *ControlResourceSets*  the UE determines a RS resource index  providing a RS resource with 'QCL-TypeD' in  - the TCI state or the QCL assumption of a CORESET with the lowest index, if CORESETs are provided in the active DL BWP  - the active PDSCH TCI state with lowest ID [6, TS 38.214], if CORESETs are not provided in the active DL BWP  <unrelated part omitted> 9.2.2 PUCCH Formats for UCI transmission <unrelated part omitted>  If a UE  - reports *beamCorrespondenceWithoutUL-BeamSweeping*,  - is not provided *pathlossReferenceRSs* in *PUCCH-PowerControl*,  - is provided *enableDefaultBeamPlForPUCCH*, and  - is not provided *PUCCH-SpatialRelationInfo*, and  - is not provided different values of *CORESETPoolIndex* in *ControlResourceSets*  a spatial setting for a PUCCH transmission from the UE is same as a spatial setting for PDCCH receptions by the UE in the CORESET with the lowest ID on the active DL BWP of the PCell. |

TP#10 for clause 6.2.1 of TS38.214 (TP from Apple):

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| 6.2.1 UE sounding procedure <unrelated part omitted>  When the higher layer parameter *enableDefaultBeamPlForSRS* is set ‘enabled’, and if the higher layer parameter *spatialRelationInfo* for the SRS resource, except for the SRS resource with the higher layer parameter *usage* in SRS-ResourceSet set to 'beamManagement' or for the SRS resource with the higher layer parameter *usage* in SRS-ResourceSet set to ‘nonCodebook’ with configuration of *associatedCSI-RS*, is not configured in FR2 and if the UE is not configured with higher layer parameter(s) *pathlossReferenceRS*, the UE shall transmit the target SRS resource, and if UE is not configured with different values of *CORESETPoolIndex* in *ControlResourceSets*  - with the same spatial domain transmission filter used for the reception of the CORESET with the lowest *controlResourceSetId* in the active DL BWP in the CC.  - with the same spatial domain transmission filter used for the reception of the activated TCI state with the lowest ID applicable to PDSCH in the active DL BWP of the CC if the UE is not configured with any CORESET in the CC |

Issue#7: For aperiodic SRS, application timing of the updated spatial relation by MAC-CE is unclear in current specification.

TP#11 for 6.2.1 of TS38.214 (TP from ZTE):

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| 6.2.1 UE sounding procedure <Unchanged part omitted>  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* is set to 'aperiodic':  <Unchanged part omitted>  - when a UE receives an spatial relation update command, as described in clause 6.1.3.xx of [10, TS 38.321], for an SRS resource, and when the HARQ-ACK corresponding to the PDSCH carrying the update command is transmitted in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions on updating spatial relation for the SRS resource shall be active starting from the first slot that is after slot . The active spatial relation at the slot of SRS transmission is applied for the SRS transmission. [The update command contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the updated SRS resource set. Each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the update command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the update command if present, same serving cell and bandwidth part as the SRS resource set otherwise.] When the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set to 'antennaSwitching', the UE shall not expect to be configured with different spatial relations for SRS resources in the same SRS resource set. |

# Discussion

Based on the identified issues/alternatives summarized in section 2, companies are encouraged to provide their views on TP#1, TP#2, …, TP#11 in Section2.

**Companies’ view (to be updated)**

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| Company name | View |
| ZTE | TP#1: Support  TP#2: Support  TP#3: Support  TP#4: The TP is incomplete. It is due to that the CORESET is QCLed with the RS with "QCL-TypeD" (Rx spatial domain filter may be similar for DL), but the SRS shall use the same spatial relation/spatial domain filter as the RS with "QCL-TypeD" (for UL transmission). Consequently, the corresponding description in other paragraphs, e.g., in TP 4 in 6.1 UE procedure for transmitting the physical uplink shared channel, should be reused to align with the already agreement. The TP#4 should be updated in blue.   |  | | --- | | 6.2.1       UE sounding procedure  < Unchanged parts are omitted >  When the higher layer parameter *enableDefaultBeamPlForSRS* is set ‘enabled’, and if the higher layer parameter *spatialRelationInfo* for the SRS resource, except for the SRS resource with the higher layer parameter *usage* in SRS-ResourceSet set to 'beamManagement' or for the SRS resource with the higher layer parameter *usage* in SRS-ResourceSet set to ‘nonCodebook’ with configuration of *associatedCSI-RS*, is not configured in FR2 and if the UE is not configured with higher layer parameter(s) *pathlossReferenceRS*, the UE shall transmit the target SRS resource on a CC  -     ~~with the same spatial domain transmission filter used for the reception of~~ according to the spatial relation, if applicable, with a reference to the RS with 'QCL-TypeD' corresponding to the QCL assumption of the CORESET with the lowest *controlResourceSetId* in the active DL BWP ~~in~~ of the CC.  -     ~~with the same spatial domain transmission filter used for the reception of~~ according to the spatial relation, if applicable, with a reference to the RS with 'QCL-TypeD' in the activated TCI state with the lowest ID applicable to PDSCH in the active DL BWP of the CC if the UE is not configured with any CORESET in the active DL BWP of the CC |   TP#5: Support  TP#6: Support  TP#7: Support  TP#8: Support  TP#9: "Primary cell" can be replaced by "the serving cell" ("same" is not needed). Then, regarding mTRP based transmission, how about the scenario of single DCI based multi-TRP transmission, which seems to be missing in the TP. For simplification, we may NOT need to update the spec considering that we already have the agreement of scope of default beam and pathloss RS method (e.g., single TRP) as conclusion.  TP#10: Same comment as above in TP#9.  TP#11: Support. |
| Samsung | Issue#13: Support TP#1, TP#2, TP#3, and TP#4  Issue#14: Support both TP #5 and #6  Issue#15: Support both TP #7 and #8  Issue#7: No need for further correction. We think TP#8 already covers the issue. |
| CMCC | TP#1: Support  TP#2: To align with the description in section 7.1.1, “cell” can be replaced by “serving cell”.   |  | | --- | | 7.1.1 UE behaviour  < Unchanged parts are omitted >  -     If  -     the PUSCH transmission is scheduled by a DCI format 0\_0 on the serving cell,  -     the UE is not provided PUCCH resources ~~for~~ on the active UL BWP of the serving cell, and  -     the UE is provided *enableDefaultBeamPlForPUSCH0\_0*        the UE determines a RS resource index  providing a periodic RS resource with 'QCL-TypeD' in the TCI state or the QCL assumption of a CORESET with the lowest index in the active DL BWP of ~~the scheduling cell for~~ the ~~serving~~ serving cell  -     If  -     the PUSCH transmission is scheduled by a DCI format 0\_0 on the serving cell,  ~~-     the UE is not provided a spatial setting for PUCCH resources on the active UL BWP of the primary cell [11, TS 38.321], and~~  -     the UE is configured with PUCCH resources on the active UL BWP of the cell where all the PUCCH resource(s) are not configured with any spatial relation, and  -     the UE is provided *enableDefaultBeamPlForPUSCH0\_0*        the UE determines a RS resource index  providing a periodic RS resource with 'QCL-TypeD' in the TCI state or the QCL assumption of a CORESET with the lowest index in the active DL BWP of the ~~primary~~ serving cell  < Unchanged parts are omitted > |   TP#4: Support  TP#5: Support  TP#6: Support  TP#7: Support  TP#8: Support  TP#9 and TP#10: Not support. The agreement in RAN1#99 meeting identified that the default spatial relation and PL RS is applied ‘at least for the single TRP case’, which did not preclude multi-TRP case. It may be better to modify the spec with further discussion on the default spatial relation and PL RS for Multi-TRP.  TP#11: Support |
| Ericsson | TP#1: support TP#2: not support, this is not needed TP#3: ok, but the additions of “of a cell” are unnecessary. TP#4: the addition of “the active DL BWP of” is necessary, but the rest is not TP#5, TP#6: Almost support. The parameter names are  simultaneousTCI-UpdateList-r16  simultaneousTCI-UpdateListSecond-r16  simultaneousSpatial-UpdatedList-r16  simultaneousSpatial-UpdatedListSecond-r16  TP#7: support TP#8: support TP#9: we are ok to exclude multi-TRP, but we do not understand the motivation for changing “primary cell” to “serving cell” TP#10: support TP#11: ok |

# Conclusion (to be updated)

From the email discussion [100b-e-NR-eMIMO-MB1-03], xxx

# References

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| **TDoc** | **Title** | **Source** |
| [**R1-2001564**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001564.zip) | Remaining issues on multi-beam enhancements in R16 | Huawei, HiSilicon |
| [**R1-2001597**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001597.zip) | Maintenance of multi-beam operation | ZTE |
| [**R1-2001679**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001679.zip) | Discussion on remaining issues on multi beam operation | vivo |
| [**R1-2001823**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001823.zip) | Remaining issues on multi-beam operation | MediaTek Inc. |
| [**R1-2002271**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002271.zip) | Discussion on remaining issues on multi-beam operation | Spreadtrum Communications |
| [**R1-2002338**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002338.zip) | Remaining issues on beam management enhancement | Apple |